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THE BEGINNING OF THE IRON AGE IN INDIA

BY

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(Poona)

The problem here discussed is: When was iron first produced from natural ores in India, in quantity sufficient to be important in the means of production? This means primarily for agriculture. Iron was the cheap metal which made agriculture possible in monsoon jungles; bronze had always been reserved for the few, so that the bronze age was normally one of warriors who pastured cattle. Exceptions were the great river valleys passing through deserts, where no forest had to be cleared and the flood-deposited silt could be stirred up with a wooden plough or harrow: the Nile, Mesopotamia, the Indus. In contrast, the Gangetic basin with its very fertile alluvial soil but much greater rainfall was under dense forest till the iron age. The harrow would certainly not do where stones and roots were a serious problem; on the other hand, the forest could be cleared by fire only along the Himalayan foothills, where such obstructions would most commonly be expected in ploughing. One further essential difference between the Ganges area and the Panjāb is that food-gathering was always much easier in the east, whereas pastoral life remained the norm in the Panjāb nearly till Alexander's day.

The late Col. D. H. Gordon stated [1]). "Once one gets down to (Indian) deposits that must date earlier than 400 *BC*, there is no iron and, furthermore, it would appear likely that at most sites the culture which continues to that date was one that utilized copper and stone". The previous page of the same source reads: "There was no iron with

*) The reader might find my *Introduction to the Study of Indian History* useful for the background references and discussion.

1) D. H. Gordon: *The Pre-historic Background of Indian Culture* (Bombay 1958) p. 155 and 154.

the invaders of India between 1800-1400 *BC*.....The Hittites kept the secret of the process (of smelting and forging iron) which would make iron a serious competitor with bronze. ...Not till 1200 *BC* (do we) get iron-working starting to spread all over western Asia, the Caucasus and eastern and central Europe. By 1100 *BC* iron was superseding bronze on the Iranian plateau and appears in graves in Luristan and at Necropole *B* at Sialk.... By 800 *BC* there was a full iron age throughout eastern Europe and western Asia. Copper and bronze were no longer economic propositions and gave way to iron, articles of which were produced far more cheaply and in considerable quantity, making the possession of metal tools possible for those who had to content themselves with stone". The writer, a competent archaeologist, implied that India remained inexplicably backward by not adopting the new metal.

Sir Mortimer Wheeler takes the position that Indians learned the use and preparation of iron only from the Achaemenid conquest. He even states this as a fundamental postulate [1]): "There is at present no clear evidence for the systematic use of iron anywhere in the (Indian) subcontinent before (the VI-th century *BC*) unless sporadically in the northwestern region. Attempts to equip the Vedic Aryans in the middle of the second millennium *BC*, or their successors of the Brāhmaṇa period, with iron have no solid substance.... The earliest unequivocal literary evidence for the use of iron by Indians are the well-known references by Herodotos and Ktesias (V-th century *BC*); and the earliest firm archaeological evidence for the normal use of iron within the subcontinent is provided by the First Taxila (Bhīr Mound) for which Sir John Marshall's initial date of *c.* 500 *BC* is unlikely to be varied significantly. It is reasonable in the present state of knowledge to associate this developed use of iron with the imposition of Achaeme-

1) Mortimer Wheeler: *Chārsadda/A metropolis of the North-west Frontier.* (Oxford University Press, 1962; for the British Academy and the Government of Pakistan); pp. 33-4. The same position was taken earlier in Wheeler's *Early India & Pakistan to Ashoka* (London, 1959), where he puts the Gangetic copper hoards 'at a guess' before the 8th century *BC*, but fails to see iron before the Achaemenids. Incidentally, the existence of two Gandhāras, on both sides of the river, must be noted.

nid suzerainty first upon Gandhāra and then upon the Indus region by Cyrus (558-530 *BC*) and/or Darius (521-485 *BC*), with the consequent quickening of trade and civic life in the north-west".

Wheeler's fundamental contributions to Indian archaeology and especially his carefully worked out ceramic index would make his dating difficult to challenge, had it been positive in substance and based upon his own work over an extensive region. Unfortunately, the negative statements by Gordon and Wheeler would be credible only if Indian archaeology were reasonably complete—as it definitely is not. Marshall's date for Taxila I may turn out to be correct, but he normally relied upon pure divination unsullied by logic or facts so that I must excuse myself from taking it as evidence of anything. The dating in any case has not been arrived at by chemico-physical methods [1]), which are still not capable of giving error-free estimates though they remain the sole permissible criteria for absolute dating. Both Gordon and Wheeler (like all others before them) have taken Herodotos and Ktesias (known only at second hand) as reliable literary evidence; but nothing in Herodotos says that Achaemenid suzerainty extended east of the Indus. The main question would not be the quickening of civic life but the availability of local iron ores, without which there is no point in discussing the iron age in India. So far as I know, there is no iron ore worth the mention in the Indus region or even the Panjāb proper [2]). The best northern ores come from southeastern Bihar, a thousand miles from Achaemenid territory. The question has therefore

1) The most publicized such method is by radiocarbon, which normally is too expensive for more than a single run and thus avoids answering questions about errors of estimation caused by counter variation, counter fatigue, &c, not to speak of poor statistical methods employed. Geomagnetic measurements and fluorine content used to supplement C-14 at the same site would be useful, but they are never done in conjunction. I am told that Pāndu Rājar Ḍhibi in west Bengal shows iron in a VI-th century context, but again the findings might be questioned on archaeological grounds, like reports of still earlier iron at Kosambī.

2) At least, Herodotos and Ktesias do not specify any, nor are iron articles included in the tribute-list of Darius's satrapy on the Indus. Strabo and other classical writers noted (after Alexander's companions) that Indians of the Panjāb were singularly poor metallurgists and did not know how to exploit any ore in the local hills; but no specific mention is made of iron ore even then.

to be discussed on the basis of all available literary evidence as collated with archaeology.

Ktesias indicates that two swords of superb quality, made of Indian steel, were presented to Artaxerxes Mnemon [1]). The process was simple enough, to judge from modern technique [2]), though it needed excellent ore and long practice. Steel of Indian origin remained famous in Europe as 'Damascus steel', till the last century. There is no reason to doubt that, even before 400 *BC*, India could export the finest steel of the day. But it must follow that Indian iron was produced in quantity long before that time, for the metallurgical technique needed to produce steel is well beyond that for iron. If, therefore, Gordon could not find iron before 400 *BC* in Indian excavations, it means simply that the archaeology of the sub-continent is far from satisfactory, and that most of the excavation has been at the wrong places for such discovery to be possible. Herodotos describes Indian levies [3]) in the great army which Xerxes led in 482 *BC* to the conquest of Greece: "The Indians wore cotton dresses, and carried bows of cane and arrows also of cane with iron at the points". Though the implication of Herodotos's account is that every contingent was armed in its own traditional style with weapons of local manufacture, it could always be argued that the

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1) According to Plutarch's *Life* of Artaxerxes, Mnemon was Artaxerxes II. It was against this Mnemon that Xenophon marched with the Ten Thousand, and it was at his court that Ktesias was physician. But J. B. Bury's *History of Greece* (Modern Library edition, New York 1937) makes matters worse by taking (in the index) Artaxerxes II as Longimanus (who, according to Plutarch, was Artaxerxes I). Bury's slip would put Indian steel fifty years earlier. I follow Plutarch, who is undoubtedly correct here.

2) Lewis Rice: *Mysore/A Gazetteer compiled for Government*, vol. I (London 1897), revised ed. pp. 531-533. But the pieces obtained were each of about 75 grams weight and of highly variable quality, though on the whole so good that the British steel-makers expected such Indian steel to become of importance even at the end of the 19th century.

3) Herodotos, Book vii; both the Rawlinson translation and that of Aubrey de Selincourt for Penguin classics agree in substance. But Indians here mean the tribes on the Indus or to the west. Darius's own list of conquests and provinces reads Kambujiya, Gandāra, Hinduš, in that order and would indicate western Afghanistan, Kandahār, and the area along the west bank of the Indus respectively.

Indians were supplied with iron for their arrowheads by their Achaemenid commanders.

For the iron-ore country, however, we have one ancient record well worth consideration, the Pāli *Sutta-nipāta* [1]). The language is the most archaic of any work in the whole Buddhist canon; the style too is simple and direct. Asoka mentions several of the *suttas* now found in this book (and nowhere else in the canon) with special approval in an edict addressed to the Buddhist Order. There is no question but that the work is pre-Asokan and contains the oldest of Buddhist tradition. The fourth discourse in the collection is of 'Farmer Bharadvāja', (*Kasi-Bharadvāja-sutta*), a brahmin who farmed land at Dakkhiṇāgiri in Magadha. This is the portion of Mirzapore district along the southern bank of the Ganges. The word *phāla* for plough-share occurs in both the prose and the metrical portions of the discourse. The simile runs: 'like a *phāla* heated for a whole day and plunged suddenly into water...'. Bronze treated like this would become brittle and useless, apart from being much too costly for ploughshares. Iron reduced from ores by any primitive method comes out as a spongy mass which has to to be heated and forged repeatedly as well as hardened by sudden chilling before it is of any use for tools. The death of the Buddha is dated at either 543 *BC* or 483 *BC*. The sermon is undated, but its context shows that the Buddha had not reached the height of his reputation in Magadha, being then comparatively unknown. It follows, even on the latest possible dating for the Buddha's decease, that agriculture and the iron plough-share were in general use in Bihar before 500 *BC*. The particular region of the *sutta* still has good supplies of an important and rich iron ore, haematite.

The far-fetched Achaemenid theory, which would not be worth discussing without the weight of Wheeler's archaeological experience behind it, can be dismissed without difficulty. A famous incident of

1) There is no essential difference here in any of the printed texts, of which two editions for the Pali Text Society are standard. I have followed the text as printed by P. V. Bapat to accompany my father's Marāṭhī translation (Dharmānanda Smārak Sāhitya, no. 4, Poona 1955).

the Buddha's life is his 'First Meditation' [1]). The Buddha-to-be, while yet a small child, was left in the shade of a convenient tree while all the Sakyans including his father were engaged in ploughing. There is no reason to doubt the antiquity of the tradition , for the episode proved rather embarrassing to later Buddhists and had to be embellished by coating the ploughs with precious metals. That the Buddha's father, a kṣatriya and supposedly a king, could set his hand to the plough like any common peasant would not be an invention of later date. The Sakyan territory runs along the Nepal border of Gorakhpur and Basti districts in UP. The land may be cleared by fire, like the whole chain of (foothill) settlements from Hastināpura to Champaran district and thence south to Rājgir; but it cannot be settled permanently without the iron ploughshare. Tradition, Chinese pilgrims' accounts, and archaeology (as well as the Asokan column at Rummindei) prove that the settlements did exist early in the VI-th century, and probably in the VII-th century *BC*. Their existence without iron seems incredible. For that matter, the early settlement of Banāras and Rajgir can only be credited to the proximity of iron ores south of the river. Last of all, it does not seem possible to develop the Magadhan philosophies (Buddhism, Jainism, that of the Ājīvikas &c) in a pastoral context. Only agriculture would call forth such new religious ideas; but I shall not expand this here. It may be pointed out, however, that none of those settlements of the Gangetic 'chain', which joined on to the famous *uttarāpatha* trade route, have an Indus stratum. All of them have to be called 'Aryan', for lack of a better term.

What of earlier, unmistakable refrences to iron in India? Let it be agreed that Ṛgvedic references to *ayas* need not mean iron, as bronze could be indicated. The plough-deities *śunā-sīrau* occur in a special Ṛgvedic hymn [2]); but the plough-share need not have been of iron.

1) The best narrative is in the introduction (*nidāna*) to the Pāli Jātakas; the text used is *The Jātakam* ed. V. Fausböll, London 1877, vol. I, p. 57. The motif is famous in Buddhist art; the ploughman in Kuṣāṇa reliefs is generally shown as a plebeian, stripped down for the work.

2) The hymn is *RV*. iv. 57. The furrow *sītā* and the verb-form *kṛṣatu* show clearly that ploughing and not hoeing is meant, though the harrow is admissible.

The case is otherwise for the *Yajurveda* where both the Black and the White recensions agree in mentioning agriculture with the plough and iron, both unequivocally, in spite of Wheeler's doubts, though the iron share may still be questioned as we shall see. In Keith's translation [1]) the prayer runs: "May for me...milk, sap, clarified butter, honey, eating and drinking at the common table (*sagdhiḥ* and *sapīti*), ploughing, rains, conquest, victory, wealth, riches, prosperity,.. low-grade grain (*kuyava*), food, freedom from hunger, rice, barley, beans, sesame, kidney-beans, vetches, wheat, lentils, millet, *Panicum miliaceum*, *Panicum frumentaceum* and wild rice (prosper through the sacrifice). May for me the stone, clay, hills, mountains, sand, trees, gold, bronze, lead, tin, iron, copper, fire, water, roots, plants, what grows on unploughed land, what grows on ploughed land, tame and wild cattle prosper through the sacrifice". As for the *Brāhmaṇa* literature, it is much more difficult to get the information in such concentrated form out of the diffuse ritualistic works; but an excellent modern summary [2]) exists which confirms the *Yajurveda*, in spite of what

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Sāyaṇa's comment on the eighth and final *ṛk* runs: *phālāḥ* = *bhūmi-vidāraka-kāṣṭhāḥ*, so that a plough or harrow completely of wood, without even an iron tip or share, is possible. Apparently, Sāyaṇa took it as such, and the brahminical injunction of *Manusmṛti* x. 84 against using wooden implements with iron points to dig the earth might be the basis of this particular comment.

1) A. B. Keith, trans.: *The Veda of the Black Yajus School[entitled]Taittiriya Saṃhitā*, Harvard Oriental series vols. 18-19, (Cambridge Mass., 1914). The mantras translated are iv. 7. 4-5, on p. 381 (vol. 19). I have made two changes in the translation, namely for *kuyava*, which can only mean edible weed-grain which grows with the cultivated grain and is difficult to separate and indeed rarely separated in the simpler type of agriculutre. Secondly 'eating and drinking in company', which is what Keith would make of *sagdhiḥ* and *sapīti* throws away an important point of information. Company may be a matter of choice, but the prayer, being in common for the whole clan, must indicate a particular type of obligatory commensality, like the common table at Sparta and Crete in Aristotle's day, and the later Indian *jāti-bhojana*. The evidence for this interpretation lies in the *ekapātraṃ* of tribes described in the 11th Book of the *Arthaśāstra*, and forms an important link between the *Arthaśāstra* and older tradition. Other such links are the words *sajāta*, *rāṣṭra*, and *aparuddha*.

2) Wilhelm Rau: *Staat und Gesellschaft im Alten Indien nach den Brāhmaṇa-Texten dargestellt* (Wiesbaden, 1957). Sections 18 and 19 (pp. 25-8) are the most important for our purpose. The dating at the first quarter of the I-st millennium *BC* is given on p. 13, without argument. For the ploughing with 12 oxen, *TS.* v.5, Keith above p. 408. I have often seen such teams in use near Śirval, 34 miles south of Poona;

Gordon and Wheeler have said. The existence of iron is not in doubt. Rau [1]) doubts the use of iron or any metal for ploughshares, while noting that drinking vessels, daggers, needles, razors, nail-trimmers, mirrors &c were being made. All of these articles would be much better in bronze than in the soft iron then available; most of them could only have been of bronze. Moreover, the use of iron for jewelry is not known, nor indeed plausible; it would then follow that iron was known, worked, prayed for, but not used for anything at all. At least, this is the ridiculous position one gets by agreeing with this author that the plough being tipped with metal is "zweifelhaft". Rau adds: "Noch weniger glaublich aber erscheint die Bespannung mit sechs, acht, zwölf oder sogar vierundzwanzig Zugochsen". There is no doubt of twelve-ox teams being used, as they still are, for ploughing heavy soils with the heavy plough; I can furnish the actual photographs. So Rau's doubts stem from ignorance of Indian farming technique, as the archaeologists' from unwillingness to study the admittedly rather difficult and boring literary works.

There remains the question of date. Keith, never the man to date Indian books too early, takes the *Yajurveda* as closed between 800-700 *BC* and in another place as 'before 600 *BC*' [2]). This seems reasonable to me, even though I doubt his statement that the Upaniṣads precede the Buddha; some Upaniṣads may do so, but certainly not all the major ones. Rau [1]) begins the tenth section of his valuable analysis by suggest-

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the heavy plough and the 12-ox team alone enable the famous black soil of the region to be cultivated satisfactorily. The team needs considerable training, but the purpose is not ceremonial by any means, as Rau would have it.

1) See page 25, note 3.

2) Keith above in his introduction, p. xli says: "This would give a later limit of about 600 *BC* for the Saṃhitā on the ground of the evidence of the technical literature". In the *Religion & Philosophy of the Veda*, also published for the Harvard Oriental Series (vols. 31-32) in 1925, Keith was more explicit (p. 20): "..a lower limit of about 600 *BC* for the latest Brāhmaṇas is obtained, from which may be deduced a date of about 800-700 for the Saṃhitas as a lower limit. The same conclusion is indicated by the facts of language...". Of course, the only absolute dating possible for early documents is from astronomical data precisely and unambiguously stated, which generally means an eclipse or a conjunction. None such are known for the Vedas, but the same reproach holds for Ktesias and Herodotos, so far as I can see.

ing that the Aryan tribes must have started from the Panjāb homelands about the first quarter of the I-st millennium *BC*, during which quarter they reached the eastern ocean. This seems rather likely too, though again the archaeologists may wish to argue the point. But let us restrict the discussion to the literary evidence. There were Aryans outside India, while even to the admirable Herodotos, not all Indians were Ayrans. In the very same passage that describes the army of Xerxes, the Greek 'Father of history' tells us that "the Medes were anciently called Arians by all people" and again that "the Arians carried Median bows, but in all other respects were equipped like Bactrians". Since, besides Indians, he also mentions the Gandarians (Gandhāra tribe) and the Pactyans (the Paktha of the 'Ten Kings' battle, *Ṛgveda* 7.18.7), the Aryans as a particular tribe seem to have preserved their entity. Indeed, Darius calls himself not only an Achaemenid and a Persian, but "an Aryan of Aryan descent", implying that the Persians were a section of the Aryans in general; but Strabo reports Aryans settled on the Indus even in Alexander's time. The Hittites, whose early knowledge of iron has been noticed and admitted, spoke an Aryan language; some of their seals of about the beginning of the first millennium show the Indian hump-backed bull and a naked goddess who fits the description of Ṛgvedic Uṣas. Mitannian texts (Boghaz Köi) indicate people, probably Medians, near lake Urmiyeh worshipping Indra, Varuṇa, Mitra, the Nāsatyas—all Ṛgvedic gods. A fairly late stratum in the *Ṛgveda*—and such documents can be stratified by experts as neatly as a dig by good archaeologists—shows old-Persian names [1]): Suśravas (and the adjective *turaṇyu*), Iṣtāśva, Iṣtaraśmi. The Indus region is known to the Avesta as one of the regular Aryan localities. Surely, this means that contact between various branches of the Aryans was not resumed only with the Achaemenids, but continued more or less

1) 'Kinless' Suśravas of *RV*. i. 53.9 & 10 is undoubtedly Kavi Husravah of the Avesta. Iṣtāśva should be Viśtāspa (not the Achaemenid, surely) and Iṣtaraśmi is equivalent to Arasmes in Greek; both are given as kings in *RV*. i. 123.13. However that Veda is taken as closed before 1200 *BC*, though the first book and the tenth may contain later additions.

uninterrupted from the first invasion early in the second millennium [1]) *BC*. If so, there is no reason to believe that all knowledge of iron and iron-working was carefully excluded from the confines of India before the Achaemenids.

Remembering that food gathering was so easy that less metal was needed, the date 800-700 *BC*, therefore, seems to me a reasonable beginning for the iron age in India, meaning thereby specifically the Gangetic basin where iron was most needed and most likely to have been worked. Wheeler puts the Northern Black Polished ware at about 500 *BC*, which need not be challenged; but his saying that its origin was contemporaneous with that of iron and of punch-marked coins—a specifically Indian type of coinage to a weight standard that is Indian but not Iranian—seems to me unjustified. Taking the Paila hoard as Kosalan [2]), the last coins must have been struck before 480 *BC*, while the number of different kings (of at least two distinct dynasties), would take the beginning of the coinage series back into the VII-th century *BC*, after iron and before the *NBP*.

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1) The interruption of references to Meluḫḫa in Mesopotamian records may be put at about 1750 *BC*, and the place is generally identified with the Indus region. The basic texts are reviewed by A. L. Oppenheim in *JAOS*. 74.1954.6-17, and I take Meluḫḫa as the Indus valley with Ṭilmun as Bahrein, following W. F. Albright's review of the same texts (and article) in the *BASOR*, though so eminent an authority as S. N. Kramer would place Ṭilmūn at Harappā.

2) *JBBRAS*. 27.1952.261-271; the list shows at least nine different kings, and we know that the last Kosalan monarch, Viḍūḍabha, did not long survive the Buddha. Also it is certain that his father Pasenadi ruled for a very long time, being crowned while still young and dying at the age of eighty, just before the Buddha. Of course, the identification of the particular coinage as Kosalan is conjectural, but the find-spot is certainly in ancient Kosala, the coins are not Magadhan in fabric or standard, nor Achaemenid. The Indian standard was generally of Indus weight-class *D*, approximately 3.5 grams corresponding to 32 *raktikā* (seeds of the *Abrus precatorius*). The Paila hoard is on the 24 *raktikā* standard. The North-west frontier coins were approximately 100 *raktikās* in weight, close to the modern rupee. The Paila Hoard cannot have been punched after the Magadhan conquest of about 480 *BC*.